WELL-PLATE MICROFLUIDICS

BACKGROUND OF THE INVENTION

[0001] This invention relates to microfluidic platforms. In particular, this invention provides microfluidic devices and methods adapted for use with standard well plate filling and reader systems.

[0002] Microfluidics relates to one or more networks of microscale channels in which a chemical or molecular process or reaction takes place by virtue of fluidic properties at such scale. The terms "microscale" and "microfluidic" typically refer to fluids provided to channels having internal dimensions of between 0.1 and 500 micrometers. While the utilization of fluidic properties in microscale platforms is relatively well-established, enhancements and the discovery of new properties are continually being made.

[0003] Certain well plate formats have achieved widespread use as a standard in the biotechnology and pharmaceutical industry sectors for high-throughput medical diagnostics, drug screening, and other applications where fairly simple chemical analysis processes are performed on multiple samples in parallel. One area that has received some attention is the trend toward fabricating microfluidic platforms to increase throughput, for performing a large number of processes or reactions simultaneously.

[0004] Multi-parallel microfluidic platforms would allow more complex chemical processes to be performed in a high-throughput mode in much the same way as more simple chemical processes can be performed with well plate formats. A recent development toward this trend is a microfluidic platform that is compatible with a standard well-plate format. Significant improvements in the number of processes or reactions that can be accomplished have been made by developing microfluidic platforms that conform to a well plate standard format.

[0005] Despite development in this area, however, numerous problems exist. Other well plate-compatible microfluidic devices do not provide a fluidic connection from one well to another well, let alone fluidic connection among three or more wells. Further, recent microfluidic devices lack an interface, in combination with two or more wells, in which diffusion or extraction can take place. One such interface is known as a laminar fluid diffusion interface (LFDI), and is formed when two or more fluid streams flow substantially in parallel in a single microfluidic structure.

[0006] Another shortcoming of recent well plate-adapted devices is their complexity, both of construction and of use. Most such devices require two or more plates that must be somehow mated together. Each plate must conform to the well plate dimensions, giving rise to mating and alignment problems. Still another problem is how to connect the wells in a well plate with the microfluidic channels in a device.

BRIEF DESCRIPTION OF THE DRAWING

[0007] FIGURE 1 shows a standard well-plate.

[0008] FIGURE 2 is a sectional view of a well-plate shown in FIGURE 1 to illustrate the wells formed on or in the plate.

[0009] FIGURE 3 shows an H-Filter-type microfluidic structure.

[0010] FIGURE 4 shows a T-Sensor-type microfluidic structure.

[0011] FIGURES 5A and 5B illustrate a microfluidic device having an array of wells and a microfluidic structure connecting at least two of the wells.

[0012] FIGURE 6 is a top view of a device showing an embodiment of a microfluidic structure connected to a number of wells.